ANALYSIS OF PROPOSED STREET CLOSURES FOR THE HEARST STRIP PARK

PREPARED FOR THE CITY OF BERKELEY
MAY 1980

prc
A Planning Research Company

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This report was produced in cooperation with the City of Berkeley, California. The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the City of Berkeley, California.

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I. INTRODUCTION

The City of Berkeley is currently developing the Hearst Strip Park located on the north side of Hearst Avenue between Grove Street and Sacramento Street. As a part of the plan for the Hearst Strip Park the City is considering to vacate (i.e. close) Grant Street and/or McGee Avenue between Hearst Avenue and Delaware Street. The goal is to make Hearst Strip Park a continuous park between Grove Street and Sacramento Street uninterrupted by streets. In order to vacate these streets, the following findings need to be made:

1. The proposed vacation should be for a public purpose. This requirement is one imposed primarily by case law.
2. Evidence should be presented that the street area to be vacated is "unnecessary for present or prospective public street purposes." (Section 8323, Streets and Highways Code)
3. Evidence should be presented so that the governing body may determine that the right of way to be vacated is not useful as a bikeway. A bikeway means all facilities that provide <u>primarily</u> for bicycle travel.

The third finding actually refers to street vacations for private development purposes. Because the proposed vacation of Grant Street and McGee Avenue would be for the purposes of a public park, the question that needs to be answered is whether vacating Grant Street and/or McGee Avenue between Hearst Avenue and Delaware Street would preclude a bikeway.

In order to make the above findings, the traffic impacts of the proposed street closures have been assessed. By closing these two street sections, the traffic volumes that use these street sections would be shifted onto other alternative routes. They key questions that had to be answered were (1) How many vehicles would be added onto each street? (2) What would be the impacts of these increases in terms of increased congestion and safety hazards? To put these impacts into perspective, mitigation measures were proposed for the significant impacts.

The first part of this report describes the existing transportation conditions in the study area. This description includes existing traffic volumes and levels of service at key locations and conditions for other modes of travel in the area. Following this, the method by which traffic shifts (caused by the proposed closures) were estimated is described, along with the resulting traffic volumes. Impacts on other travel modes are also evaluated. Potential measures are proposed to mitigate the negative impacts identified and conclusions are drawn regarding the overall effects of the proposed street vacations. The final part of this report addresses some general traffic issues surrounding the Hearst Strip Park.

The study area covers the area bound by Cedar Street on the North, Grove Street on the East, University Avenue on the South and Sacramento Street on the West. See Figure 1.

KEY

= MAIN STREETS

SCALE : 1" = 1,500'

FIGURE 1

STUDY AREA LOCATION

MAP REPRINTED WITH PERMISSION FROM CITY OF BERKELEY, DEPT. OF PUBLIC WORKS.

II. EXISTING TRANSPORTATION CHARACTERISTICS

II.1. Street System

As shown in Figure 1., the study area is bound by four arterial streets (University, Grove, Cedar and Sacramento Streets) and is bisected by another (Hearst Avenue). Other streets within the study area are local and residential in nature, with parking allowed on both sides. Figure 2 shows the existing traffic controls within the study area. There are seven signalized intersections; and stop signs are used to give priority to traffic flows on the arterial streets.

In addition to establishing the right-of-way, the traffic controls at the intersections between local residential streets are presently arranged in manners that discourage through traffic.

II.2. School Transportation Routes

The Berkeley Unified School District provides school bus transportation to the study area. The bus routes and stops within the study area are shown in Figure 3. Two buses operate between 8 and 9 a.m. and also between 2:30 and 4:00 p.m.

II.3. Bicycle Routes

As shown in Figure 4, the study area is serviced by two bicycle routes, running north-south and east-west on California Street and Hearst/Delaware Streets, respectively. These bicycle-routes may be classified as Class II bikeways,[1/] where the bikeway is adjacent to, but separated from, automobiles and pedestrians. In the case of the existing bikeways, separation is achieved through paint stripes between the bikeway and the moving lanes of auto traffic.

1/ For definition of bikeway classifications, see Appendix A.

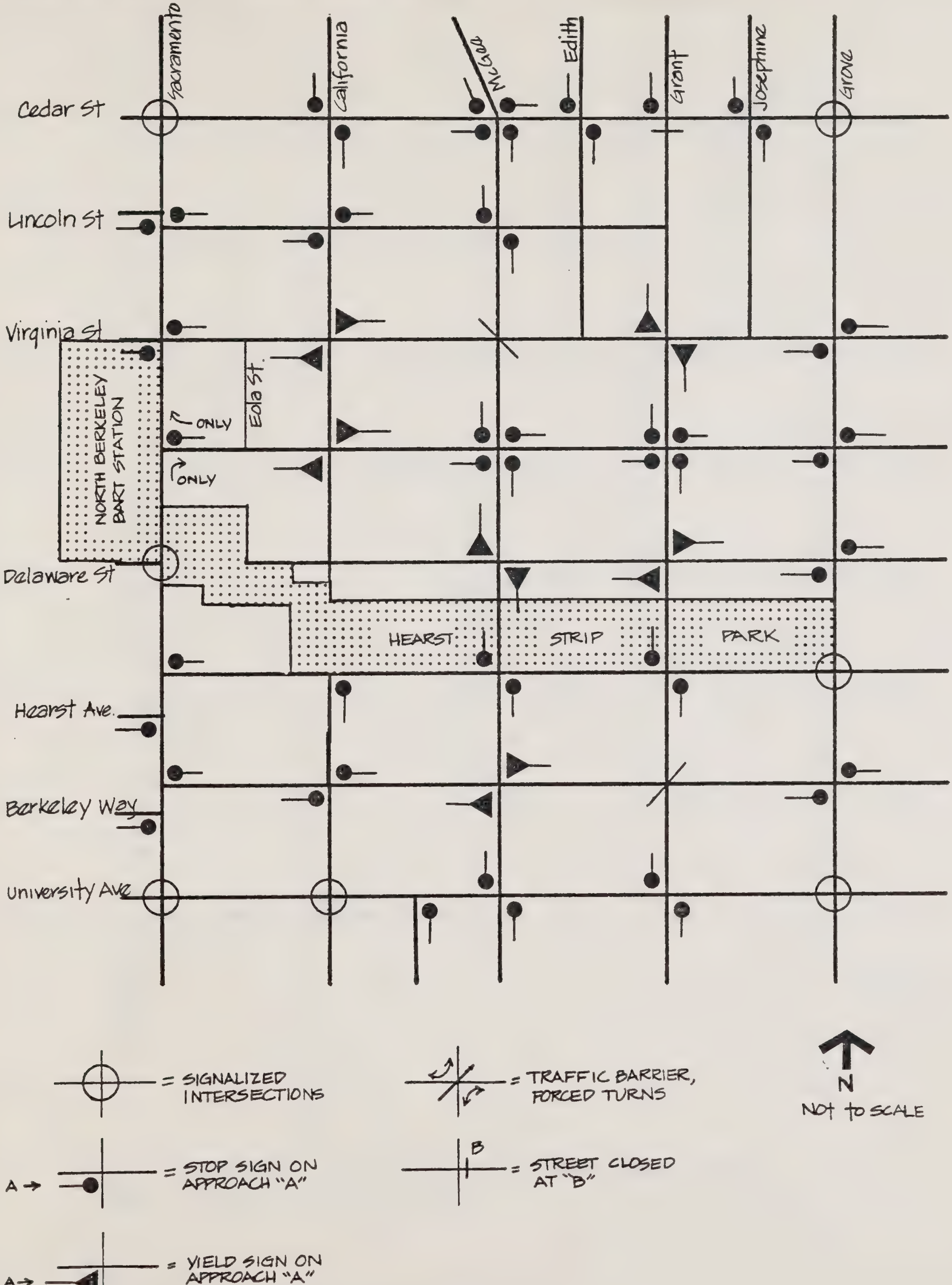

FIGURE 2

EXISTING TRAFFIC CONTROLS

NOTE: INTERSECTIONS W/NO INDICATIONS HAVE NO TRAFFIC CONTROL DEVICES

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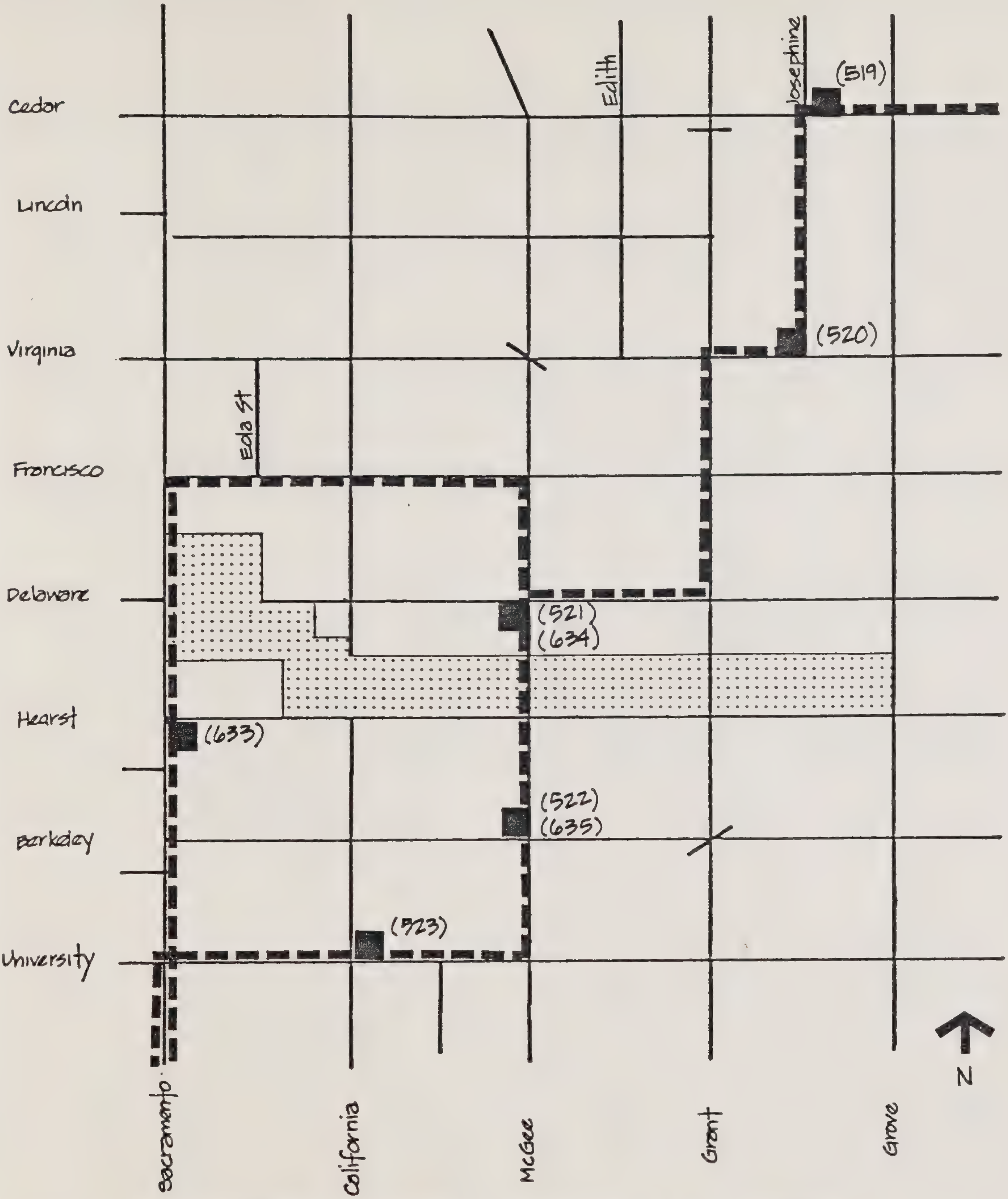
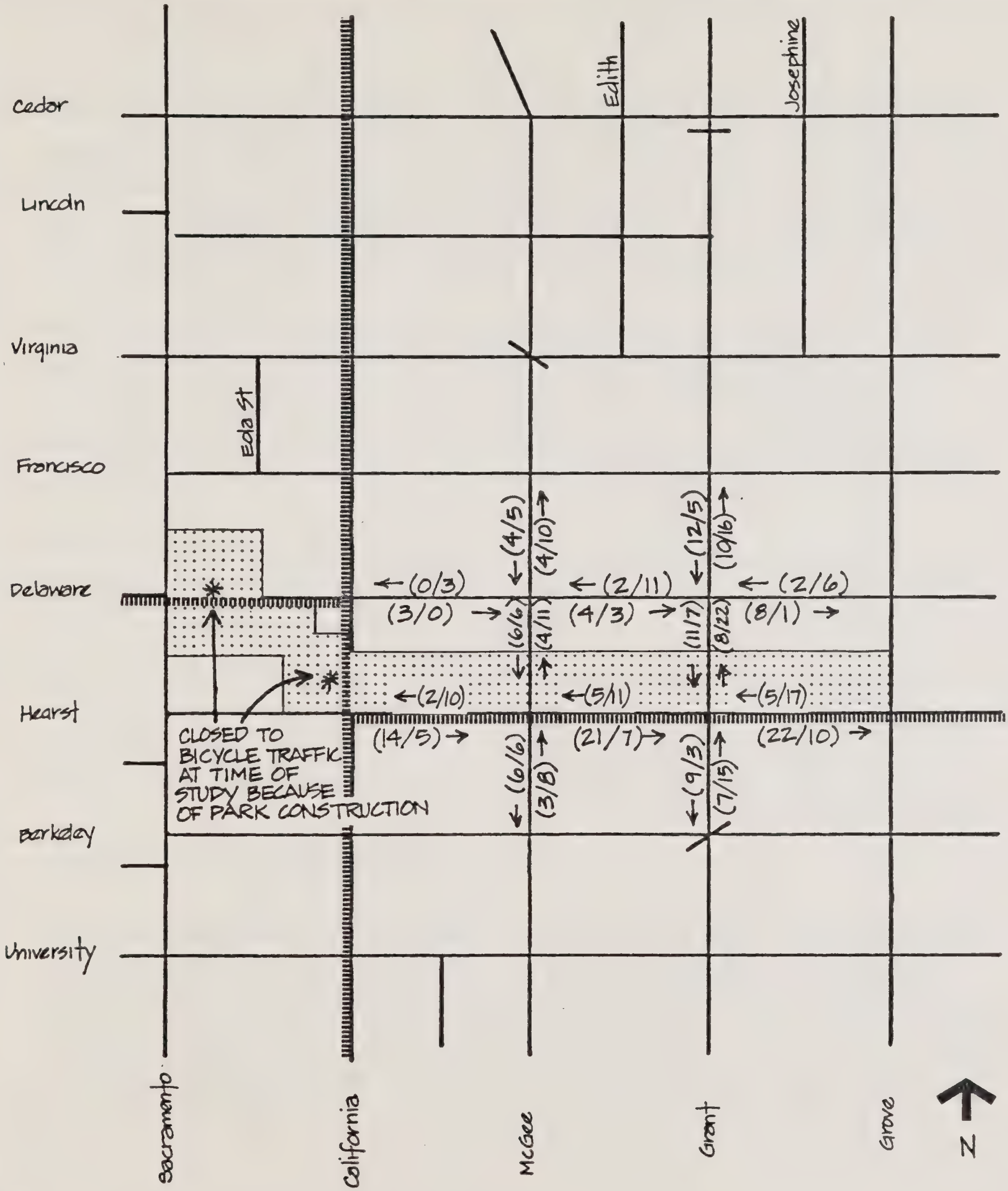


(XXX) = BERKELEY UNIFIED SCHOOL DISTRICT BUS STOP NUMBER

= SCHOOL BUS ROUTES/STOP

FIGURE 3

EXISTING SCHOOL BUS ROUTES



KEY:

= DESIGNATED BICYCLE ROUTES

(XX/YY) = (AM PEAK HOUR BIKE VOLUME/PM PEAK HOUR BIKE VOLUME)

FIGURE 4

EXISTING BICYCLE ROUTES AND PEAK HOUR BICYCLE VOLUMES AT SELECTED LOCATIONS

SOURCE: PRC VOORHEES TRAFFIC COUNTS CONDUCTED ON 3/18/80 & 3/19/80

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Presently, California Street is a lightly travelled residential street (approximately 500 motorized vehicles per day) with traffic controls in the study area providing priorities to movements on this street. Considering this factor and the existing design of the bikeway, the California street bikeway operates under fairly safe and efficient conditions.

In contrast, Hearst Avenue is an arterial street in the study area. It presently carries relatively high traffic volumes (approximately 6,500 motorized vehicles per day), with average speeds of approximately 25-30 miles per hour during the peak hours, and 30-35 miles per hour during the off-peak hours.[1/]

Under these traffic conditions, with only a paint stripe separating the bicyclists from automobile traffic, the Hearst Avenue bikeway offers poor safety conditions to bicyclists.

Figure 4 also shows peak hour bicycle volumes at selected locations. At the time these counts were made, it was observed that about 10-20 percent of the bicyclists chose to ride (or walk) on the sidewalk of Hearst Avenue. This is a direct reflection on the surface conditions of that bikeway.

II.4. Existing Traffic Conditions

(a) Traffic Volumes. Average daily traffic volumes, morning peak hour traffic volumes, and afternoon peak hour traffic volumes on the streets within the study area are shown in Figures 5, 6, and 7, respectively. By referring to Figure 5, one can see that University Avenue is by far the most heavily travelled arterial, followed by Sacramento, Grove, Hearst and Cedar, in descending order.

1/ PRC Voorhees, limited field observations 3/26/80, Wednesday.

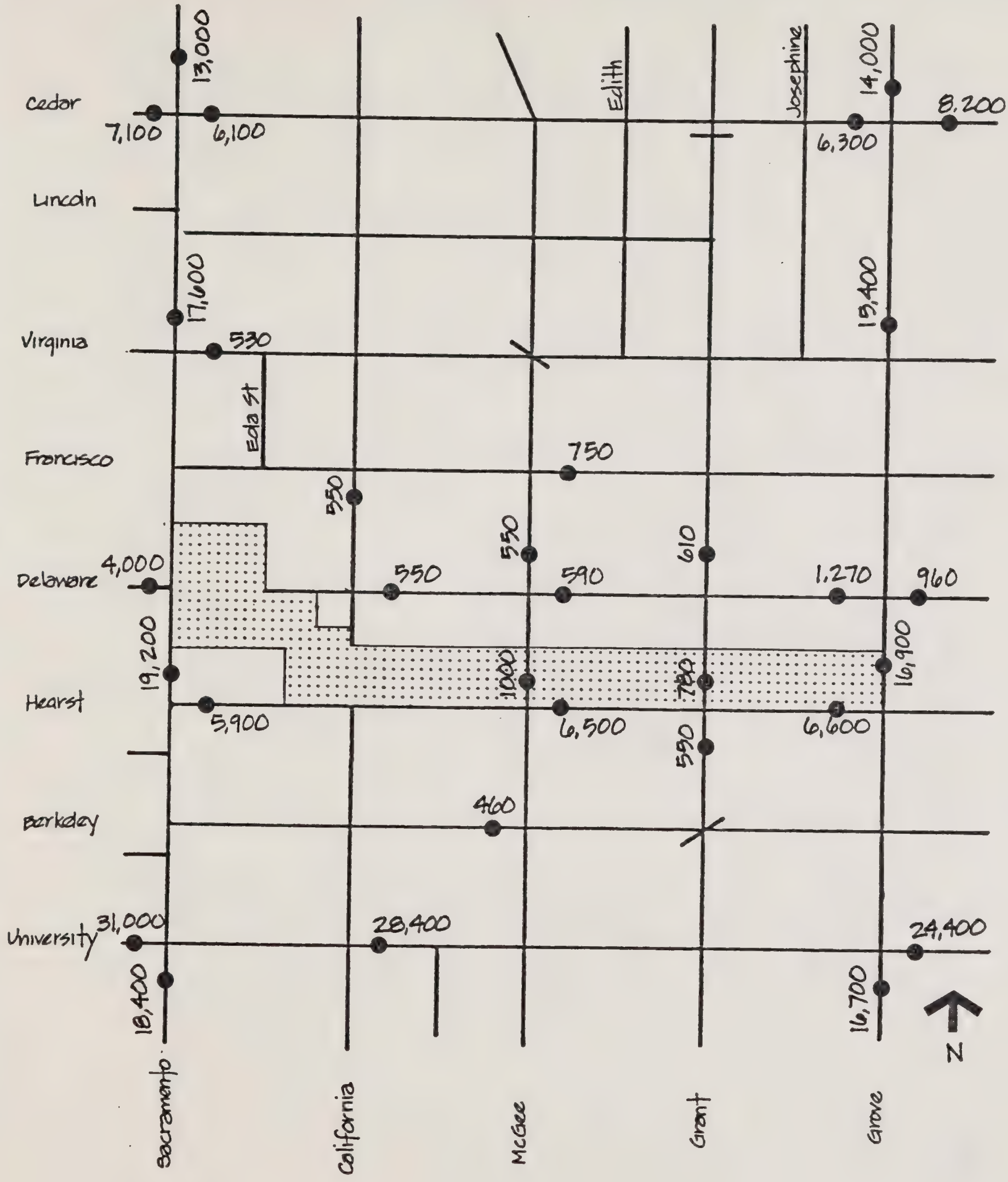

FIGURE 5

EXISTING AVERAGE DAILY TRAFFIC VOLUMES*

NOTE: VOLUMES SHOWN ARE TWO DIRECTIONAL VOLUMES

* SOURCE: CITY OF BERKELEY, DEPT. OF PUBLIC WORKS, TRAFFIC ENGINEERING DIVISION 24 HOUR COUNTS; & PRC VOORHEES ESTIMATES FROM PEAK HOUR VOLUMES.

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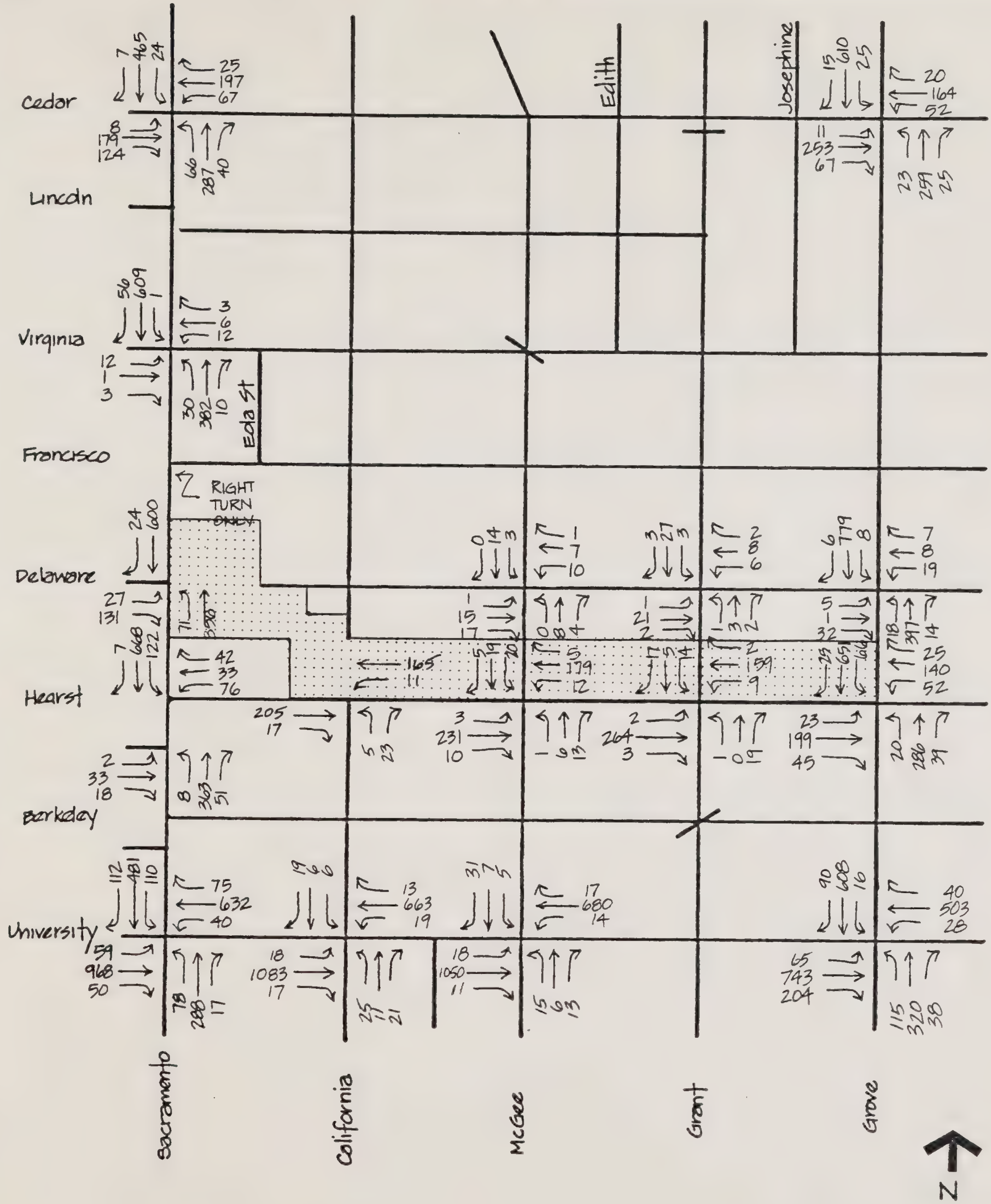

FIGURE 6

EXISTING MORNING PEAK HOUR (8:00-9:00 AM)

TRAFFIC VOLUMES*

* SOURCE: TRAFFIC COUNTS CONDUCTED BY PRC VOORHEES 3/18/80 - 3/26/80

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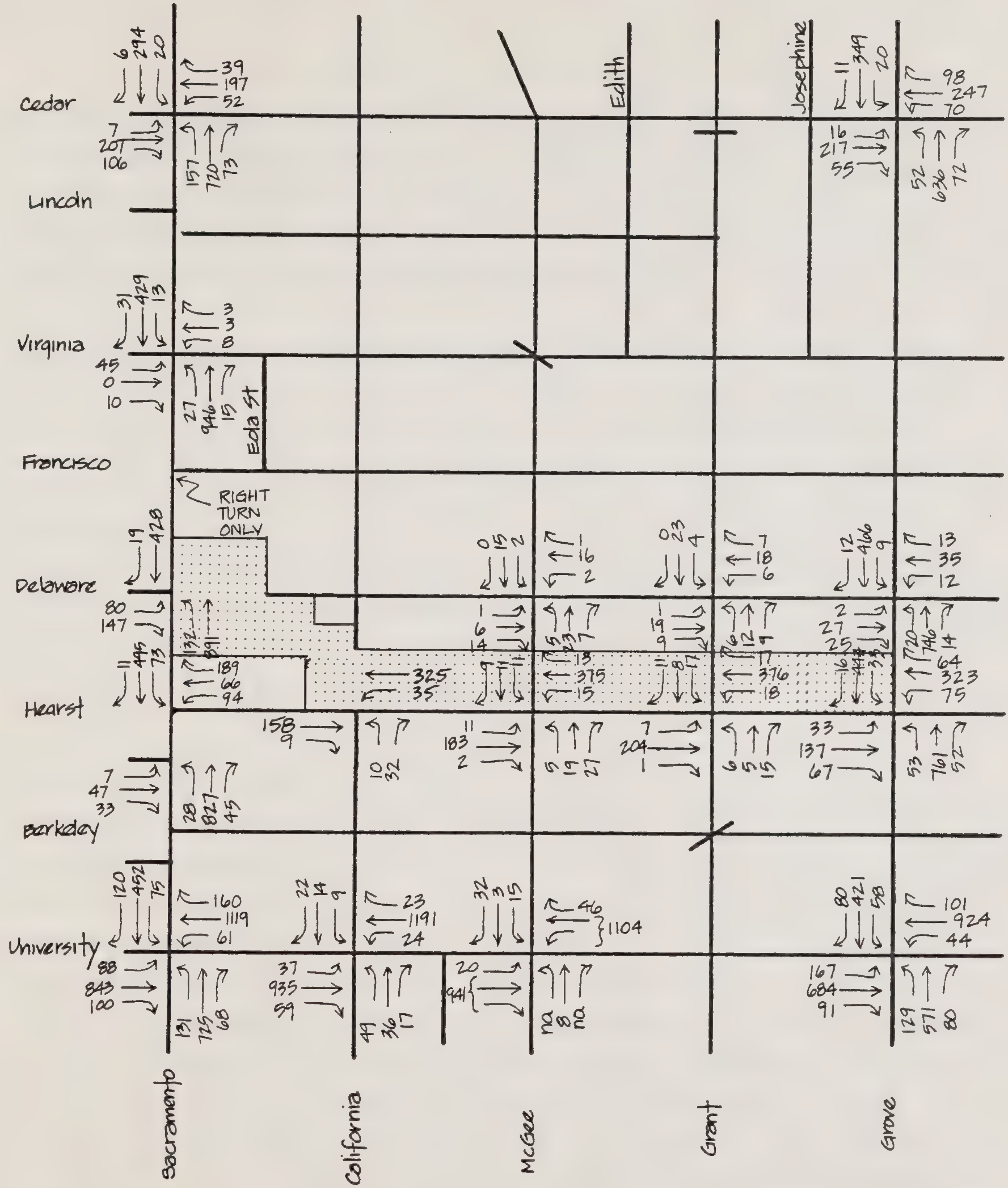

FIGURE 7
EXISTING EVENING PEAK HOUR (4:30 - 5:30 PM)
TRAFFIC VOLUMES*

* SOURCE: TRAFFIC COUNTS CONDUCTED BY PRC VOORHEES, 3/18/8 - 3/26/80

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By comparing Figure 6 to Figure 7 it can be seen that there are pronounced peak directional flows for the respective peak hours, with the morning peak direction being southbound and eastbound, and the afternoon peak direction being northbound and westbound. Also, the afternoon peak hour volumes are significantly higher than the morning peak hour volumes.

(b) Levels of Service at Key Intersections. Intersections represent critical points on a road network. Therefore the peak hour service level provided at key intersections provides a good basis for evaluating overall traffic conditions. Table 1 indicates the present service levels of the 7 signalized intersections with the study area. As can be seen, all of the signalized intersections presently operate at level of service D[1/] or better, during both the morning and afternoon peak hours. This means that the signalized intersections within the study area operate within congestion levels that are generally considered acceptable for peak hours. As expected, each of the intersections experience higher levels of congestion during the afternoon peak hour.

The street closures are also expected to affect operations at unsignalized intersections in the study area. Table 2 indicates the present afternoon peak hour operating conditions at four critical unsiganlized intersections. Typically, the critical unsignalized intersections in the study area are between a main street and a local street, with stop signs controlling the movements of the local street approaches. As can be seen from Table 2, because of the heavy peak hour volumes on the main road approaches, the movements from the minor approaches currently experience considerable delays. The movements on these approaches are largely dependent on the gaps provided by adjacent signalized intersections. As indicated in Table 2, the delays are especially long for the westbound approach of Hearst Avenue at Sacramento Street. It should be noted that the intersection volumes at Hearst and Sacramento presently satisfy the minimum volume warrants for a traffic signal.[2/]

1/ Definitions for levels of service at intersections are included in Appendix C.

2/ Caltrans, Traffic Manual, Chapter 9, 1977, pp. 1-6.

Table 1

EXISTING LEVELS OF SERVICE OF SIGNALIZED INTERSECTIONS

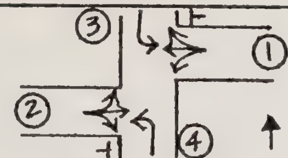
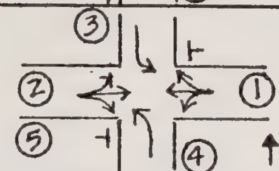
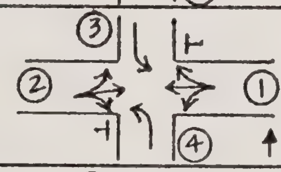
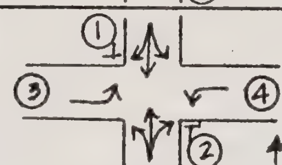
Intersection	Level of Service 1/ 2/	
	A.M. Peak	P.M. Peak
University at Grove	B/C	C/D
University at California	A	A
University at Sacramento	B	D
Sacramento at Delaware	A	A
Sacramento at Cedar	A	B
Grove at Cedar	A/B	D
Grove at Hearst	A	C

1/ Levels of Service of intersections are defined in Appendix C.

2/ Calculated from existing traffic volume data using the sum of the volume over capacity ratios of the critical movements through the intersections.

Table 2

CURRENT OPERATING CONDITIONS OF KEY UNSIGNALIZED INTERSECTIONS

Intersection	Traffic Control/ Constrained Movements	P.M. Peak Hour Operating Conditions[2/3/]			
		Movement 1	Movement 2	Movement 3	Movement 4
Sacramento/Hearst		very long delays	long delays[1/]	average delays	little or no delays
Sacramento/ Virginia		long delays[1/]	long delays[1/]	short delays	little or no delays
Grove/ Delaware		long delays[1/]	long delays[1/]	little or no delays	little or no delays
University/ McGee		long delays[1/]	long delays[1/]	average delays	average delays

1/ The average delays for these movements are largely dependent on gaps in the conflicting traffic flows created by adjacent signalized intersections.

2/ Estimated through field observations and capacity calculation procedures for unsignalized intersections.

3/ The terminology used for describing the operating conditions of the movements may be made clearer by the following ranges of delays identified by PRC Voorhees:

Description	Average Delays	
Little or no delays	0-10 seconds	
Short delays	11-20 seconds	
Average delays	21-30 seconds	
Long delays	31-60 seconds	
Very long delays	61-90 seconds	potential safety problems

III. ANALYSIS OF STREET CLOSURE IMPACTS AND POTENTIAL MITIGATION MEASURES

III. 1. Impacts on Traffic Volumes

The closure of McGee and Grant Streets to general vehicular traffic means that approximately 1,780 vehicle trips would be rerouted through the study area daily.[1/]

Special traffic tracking counts were conducted along the two street segments proposed for closure.[2/] It was found through these counts that approximately 100 and 140 vehicle trips would have to be rerouted during the morning and afternoon peak hours, respectively. The special tracking counts also provided a basis for disaggregating these peak hour vehicle trips by the direction that they are coming from and going to. The diverson routes of these trips were then determined through travel time studies on the street network, where the shortest alternative travel time paths were selected as diversion routes.

Figures 8 and 9 show the impacts that the street closures would have on the a.m. and p.m. peak hour volumes, respectively. In general, for arterial streets, the street closures would reduce the traffic volumes on Hearst Avenue and segments of University avenue, while increasing the volumes on the segments of Sacramento and Grove Streets south of Virginia Street, and the remaining segments of University Avenue. The segments of Sacramento and Grove Streets north of Virginia Street, and Cedar Street would not be affected by the proposed street closures.

The street closures are projected to increase the volumes on the residential streets north of Hearst Avenue, and reduce the volumes on the residential streets south of Hearst Avenue.

Also shown in Figures 8 and 9 are the projected volume changes at key intersections. The magnitude of these projected changes, are small. On the arterial streets, they represent between one and five percent of the existing traffic

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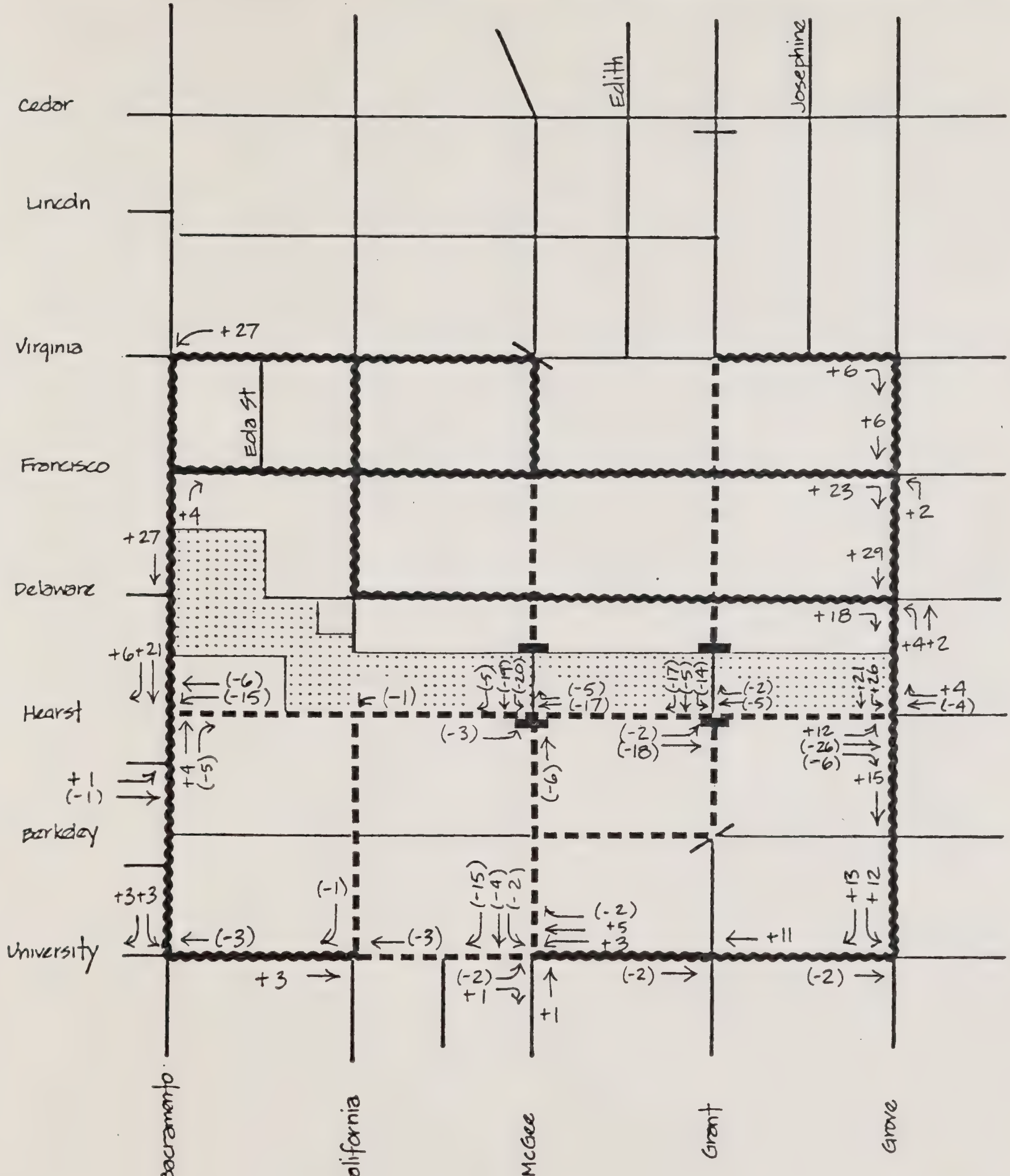
1/ Based on City of Berkeley, Dept. of Public Works, Traffic Engineering Division 24 hour counts on McGee and Grant Streets north of Hearst Avenue.
2/ See Appendix B for results of the special tracking counts.



KEY:

- STREET SECTIONS WITH INCREASES IN TRAFFIC
- STREET SECTIONS WITH DECREASES IN TRAFFIC

+XX - TRAFFIC ADDED

(-XX) - TRAFFIC REMOVED

FIGURE 8

DIVERSION OF A.M. PEAK HOUR TRAFFIC DUE TO STREET CLOSURES

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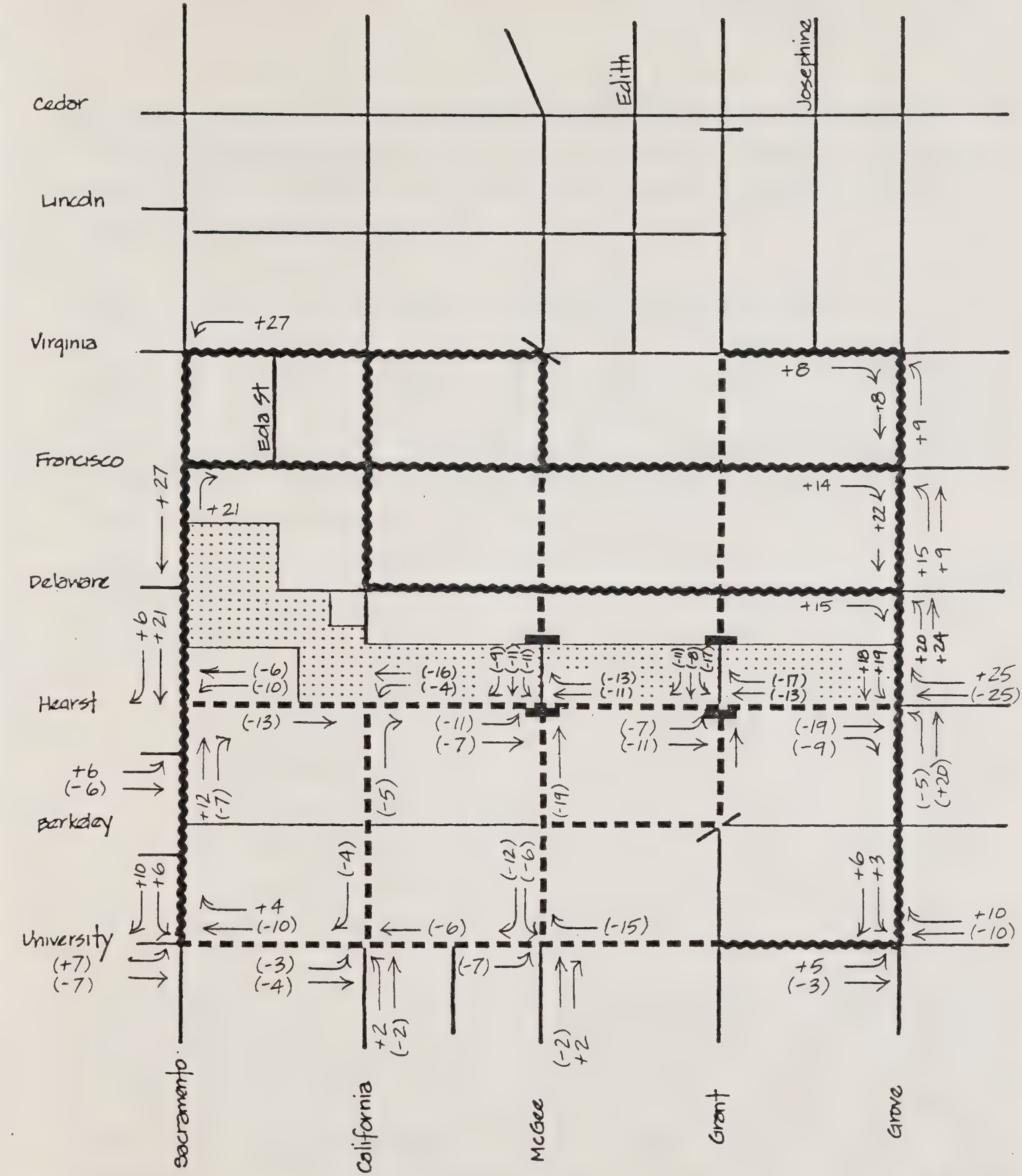

KEY:

- STREET SECTIONS WITH INCREASES IN TRAFFIC
- STREET SECTIONS WITH DECREASES IN TRAFFIC

+XX - TRAFFIC ADDED

(-XX) - TRAFFIC REMOVED

FIGURE 9

DIVERSION OF P.M. PEAK HOUR TRAFFIC DUE TO STREET CLOSURES.

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volumes. Although the volume changes along the residential streets may represent a high percentage of the existing traffic volumes, the resulting projected volumes on these streets would be low, and they would retain their local residential characteristics.

III. 2. Impacts on the Level of Service at Key Intersections

Because of the small projected changes in vehicular volumes, the levels of service classifications for the respective signalized intersections would not be changed as a result of the street closures. Therefore, the levels of service of the seven signalized intersections subsequent to the street closures would be the same as those shown in Table 1.

The unsignalized intersections projected to be impacted the most by the street closures include:

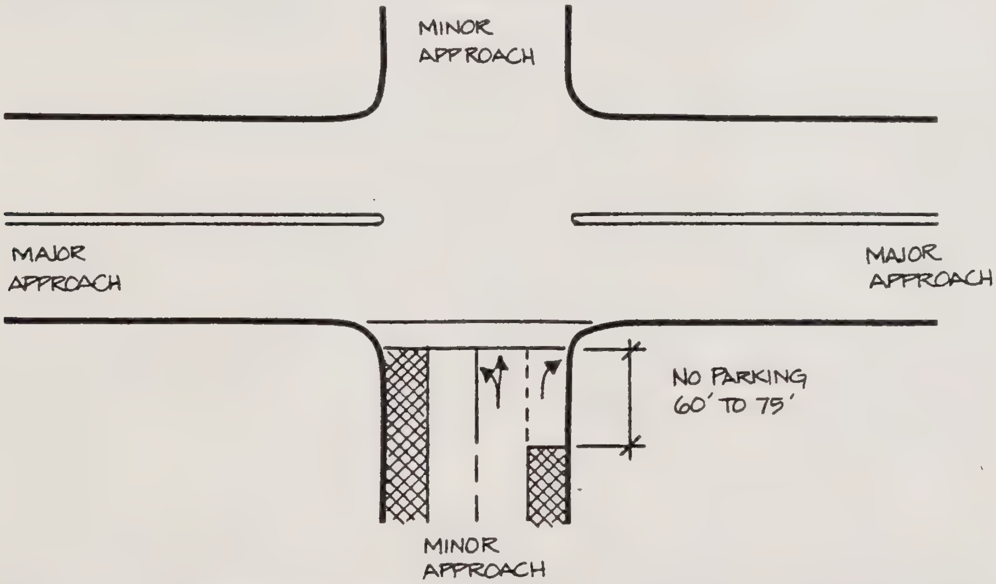
- Sacramento/Virginia
- Sacramento/Francisco
- Sacramento/Hearst
- University/McGee
- Grove/Delaware
- Grove/Francisco
- Grove/Virginia

These intersections are all controlled through two-way stop signs, with the major approaches being on the street name listed first. The intersections of Sacramento/Hearst, and University/McGee are projected to experience decreases in volumes if the street closures occur, and the peak hour delays experienced by drivers on the minor approaches of these intersections are projected to be reduced. For the remaining intersections, the delays for the minor approaches are projected to increase.

As discussed in Section II 4, during the peak hour, the delays on the minor approaches of these intersections are largely dependent on gaps provided by the adjacent signalized intersections. These gaps in the traffic stream of the major

approaches occur with each signal cycle at the adjacent signalized intersections. If the timing of the signals remain the same, and there are no drastic changes in the traffic patterns, then the occurence of gaps during the peak hour would also remain the same. Therefore, the changes in average delays for the minor approaches of these intersections are projected to be small.

While the imapcts on the average delay for the minor approaches of the unsignalized intersections are not significant, these intersection approaches would still operate with frequent long delays.1/ To mitigate any adverse impacts on the delays for these approaches and to improve upon the existing delay characteristics, the following measure may be considered for Hearst/Sacramento, Virginia/Sacramento, and Delaware/Grove:



The provision of such short right-turn pockets at these minor approaches would reduce the waiting times in queues that may form on the minor approaches. It would also improve the visibility of pedestrians crossing the minor street.

1/ See Table 2 in section II.4

III. 3. Impacts on School Transportation Routes

As shown in Figure 3 and discussed in Section II-2, four school buses presently use the segment of McGee Street proposed for closure, daily. If the street closures are implemented, the school buses must be rerouted. If the present school bus stop locations are to be kept within their present immediate locations, the resulting diverted routes may increase the travel distance of each bus run by up to 0.5 miles.

Preliminary responses from the Berkeley Unified School District indicate that such an impact is not serious.[1/]

III. 4. Impacts on Bicycles

The implementation of the street closures will not alter the physical location of the existing designated bikeways (see Section II.3), but it will affect bicycle traffic through the proposed closures segments. As noted in Section II.3 and Figure 4, these segments presently carry between 10 and 30 bicycles during the peak hours. The impact on these bicyclists depends on the eventual design of the park subsequent to the street closures. Presently, no plans have been finalized for the right-of-way of McGee and Grant Streets proposed for vacation.

It is therefore recommended that bikeways be maintained along the vacated street sections. These bikeways should be at least 7' wide. This width would be in addition to the pedestrian right-of-way.

III. 5. Impacts on Pedestrians and Safety

The proposed closure of McGee and Grant Streets would indirectly affect the pedestrian and general traffic safety in the study area. The street closures would tend to increase the speeds of vehicles on Hearst Avenue between Grove and Sacramento Streets. This is because the drivers on Hearst Avenue would have much fewer cross traffic to look out for.

1/ Meeting with Mrs. Pecot, Berkeley Unified School District Transportation Office, 4/10/80.

When traffic counts were conducted for this study, pedestrian volumes crossing Hearst Avenue at California, McGee, and Grant Streets were counted. The following tabulation summarizes the results of the counts:

	Pedestrians Crossing Hearst Avenue	
Crossing Location	A.M. Peak Hour	P.M. Peak Hour
California Street	7	10
McGee Street	26	41
Grant Street	52	36
Total	85	87

The increased vehicle speeds on Hearst Avenue would tend to worsen the safety conditions for the pedestrians and also for the bicyclists along Hearst Avenue. It is not possible to quantify by how much the safety of these pedestrians would be affected.

To mitigate these safety impacts, stop signs may be installed. Stop signs would reduce vehicle speeds at the stop-controlled intersections, thus providing safer crossing conditions for pedestrians. Three alternative schemes for installing these stop signs may be considered.

a) Install three-way stop signs at Hearst and McGee
b) Install three-way stop signs at Hearst and California
c) Install three-way stop signs at both Hearst and McGee, and Hearst and California.

The volumes entering these intersections do not satisfy the minimum traffic volume warrants for the installation of stop signs on all three approaches.[1/] Table 4 compares these three alternatives by their merits. It should be noted that each of the alternatives would provide safety improvements beyond the impacts of the street closures. This is especially true for the third alternative, where the installation of stop signs at two locations may divert traffic away from Hearst Avenue. It should also be noted that, while the installation

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1/ Caltrans, Traffic Manual, April 1975, page 4-22.

Table 4

COMPARISON OF POTENTIAL LOCATIONS FOR
INSTALLING STOP SIGNS ON HEARST AVENUE

Expected Affect On	Three-Way Stop At		
	Hearst/McGee	Hearst/California	Both
Vehicle Speed reduction on Hearst Ave.	Effective	Less effective	Very Effective
Bikeway Operation	Westbound Bicyclists may disregard sign	Allows for safer crossing and continuation for the California Street bikeway	Same effect as individual affects combined
Pedestrian Crossing	Provides a more centrally located point for safe crossing	Provides access for pedestrians crossing toward the western end of this stretch of Hearst	Provides two access points
Daily volumes on Hearst Avenue	Negligible reduction	Negligible reduction	Reduction

of stop signs increases safety for bicyclists, pedestrians and minor road traffic, they may also increase the potential for rear-end collisions on Hearst Avenue.

An alternative to the 3-way stop intersections would be the installation of pedestrian crossings at McGee and Grant with special warning signs and speed limit signs. These controls would not be as effective as the stop signs in terms of speed control, but they would avoid the rear-end collision hazards and they would be more energy efficient and less polluting in the sense that they would avoid stop and go conditions.

III. 6. Summary of Impact Analysis Conclusions

The following conclusions may be drawn from the preceding impact analysis:

- The closure of both McGee and Grant Streets at the Hearst Strip Park is not expected to create significant adverse traffic impacts to the surrounding streets.
- The street closures would tend to worsen safety conditions for bicycles and pedestrians crossing along Hearst Avenue between Grove and Sacramento Streets.
- All of the potential mitigation measures would tend to over-compensate the impacts and would generally address existing problems more so than the impacts.
- The street closures would primarily impact the present users of the street segments, who would have to take more circuitous and congested routes to reach their destinations.
- The street closures would not preclude the potential of bikeways through the vacated areas. Special bikeways through the vacated streets are recommended.

IV. GENERAL TRAFFIC ISSUES SURROUNDING THE HEARST STRIP PARK PROJECT

IV. 1. Closure of one street versus both streets

If only one street were to be closed, it is recommended that McGee Street remain open since it would provide two long park segments uninterrupted by traffic. No diversion of school buses would be required and the local drivers would be less inconvenienced. Under this scenario parking should be prohibited along the section of McGee that runs through the park, and the street should be narrowed to allow just two 12 foot lanes for moving traffic. This would improve the visibility of pedestrians moving through the park, enhance the aesthetics of the park, and minimize the barrier effects of the street. Should both streets remain open to general traffic, this design should be applied to both street segments running through the park.

IV. 2. Bicycles using pedestrian paths through the park

As noted in section II.3 there are existing safety problems for the bikeway along Hearst Avenue. If present conditions persist for that bikeway, it is projected that a considerable number of bicyclists would use the pedestrian path in the park that runs parallel to the bikeway. With the given grades of the park, the west bound bicycles are expected to move at relatively high speeds, thus posing a safety hazard to the pedestrians. Signs should be erected to discourage such bicycle usage of the pedestrian path. Meanwhile alternative schemes for improving the safety on the Hearst Avenue bikeway should be considered, including the following:

- Making Hearst Avenue a local residential street between Grove and Sacramento Streets, through the use of traffic controls that discourage through traffic, and reduce vehicle speeds.
- Building a Class I or Class II bikeway through the park.
- Designating Delaware Street a bikeway in place of the Hearst Avenue bikeway.

Appendix A

CLASSIFICATION OF BIKEWAYS

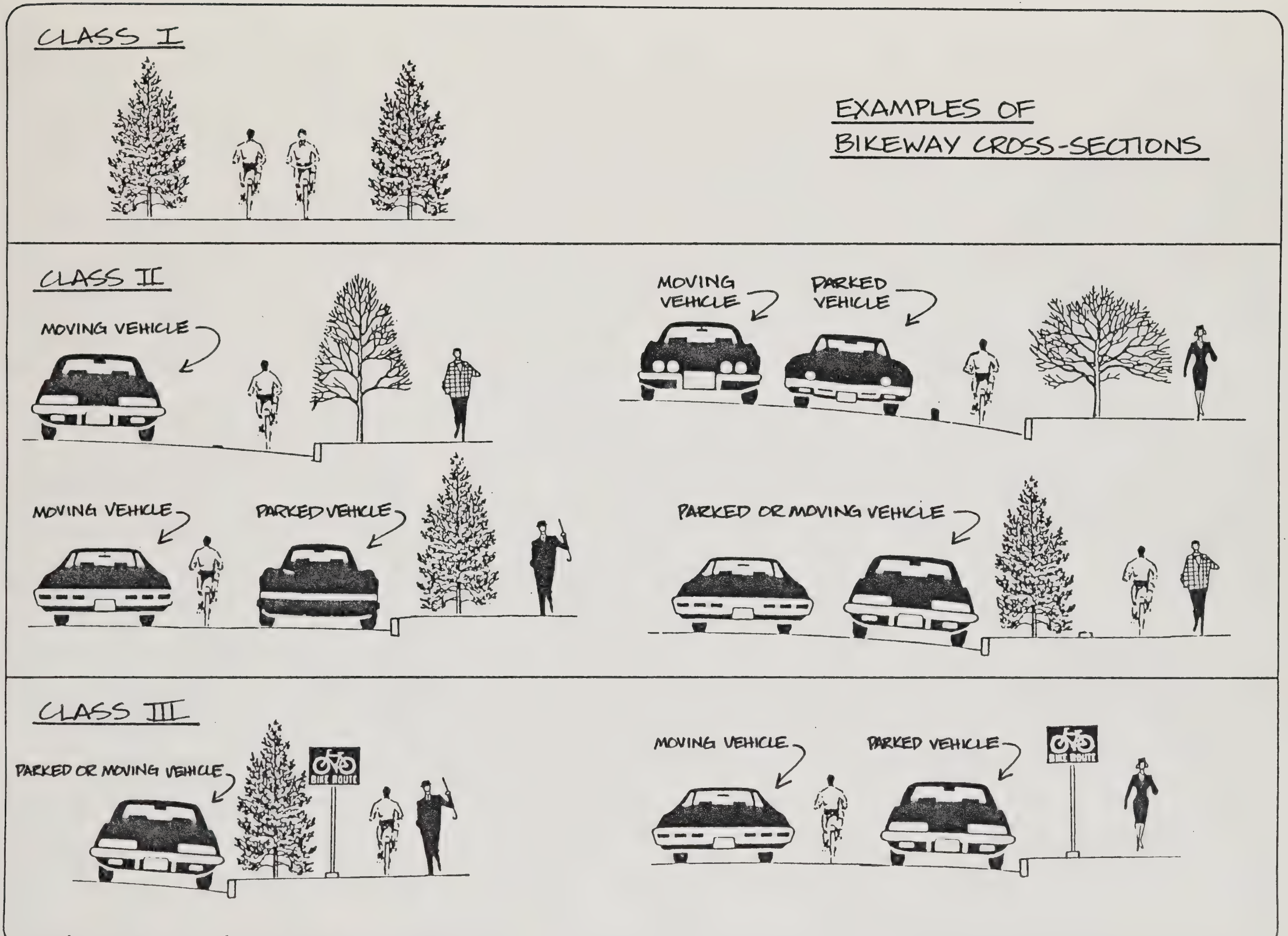
Many different classification methods for bicycle routes have been developed by planning agencies across the nation. For the purposes of this report, however, bikeways are described in the context of the following three major classifications.1/

CLASS I BIKEWAYS. These are exclusive bikeway facilities that are completely separated from automobile and pedestrian traffic. Crossings with automobiles and pedestrians are kept to a minimum or are avoided through the use of over- or underpasses. Class I bikeways will most often occur in open spaces, parks, within the right-of-way of expressways, railroads, river and canal banks, and newly planned developments.

CLASS II BIKEWAYS. These are semi exlusive bikeway facilities that are adjacent to but separated from automobile and pedestrian traffic. Bicyclists are provided a separate path, with the exceptions that it may be crossed by parking automobiles or automobiles turning into or out-of driveways, and it regularly crosses intersection streets. Class II Bikeways are segregated from automobile and pedestrian traffic with a physical barrier or by painted markings. They are one-way, occurring on both sides of two-way streets or on the right side of one-way streets. This type of bikeway will contribute the most to developing the bicycle as a supplement to the automobile for commuting and transportation in existing developments. This is because they can be incorporated as part of the overall city traffic pattern-they share common traffic corridors with other transit modes.

Source: Balshone, BL.L. et al, Bicycle Transit: It Planning and Design, 1975, and Institute of Transportation and Traffic Engineering, Bikeway Planning Criteria and Guidelines. UCLA, April 1972.

CLASS III BIKEWAYS. These are shared bikeway facilities where the bicyclists occupy the same right-of-way with either automobile or pedestrian traffic. Signs designate the road or sidewalk as a bikeway, warning automobile drivers or pedestrians that bicycles should be expected. Although this is by far the least expensive type of bikeway, it is also the least safe for the automobile, the bicyclist, and the pedestrian. The Class III bikeway should never be used on high-speed, congested roadways or on heavily used sidewalks, and is recommended only for temporary purposes.



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Appendix B

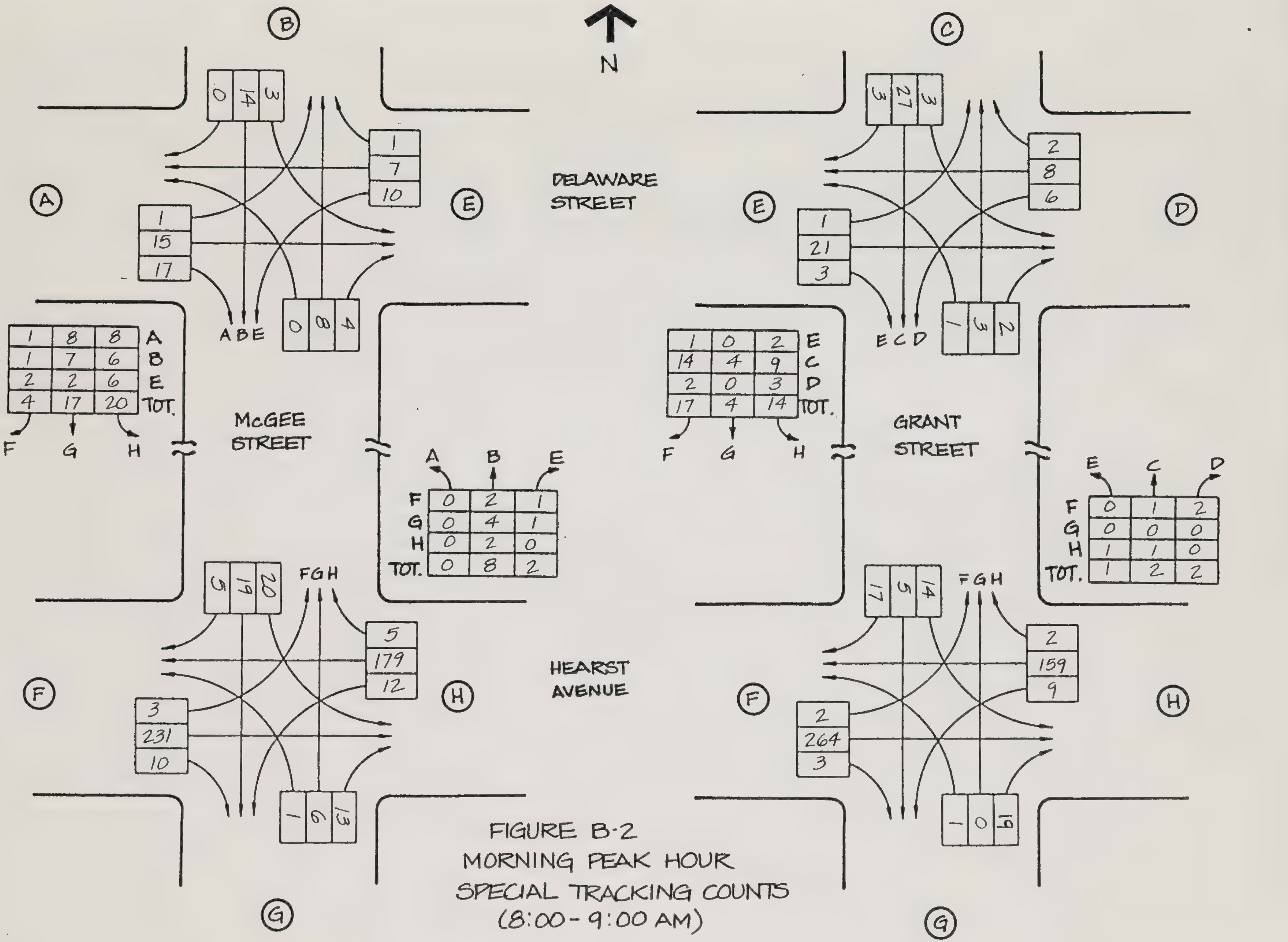

FIGURE B-2
MORNING PEAK HOUR
SPECIAL TRACKING COUNTS
(8:00 - 9:00 AM)

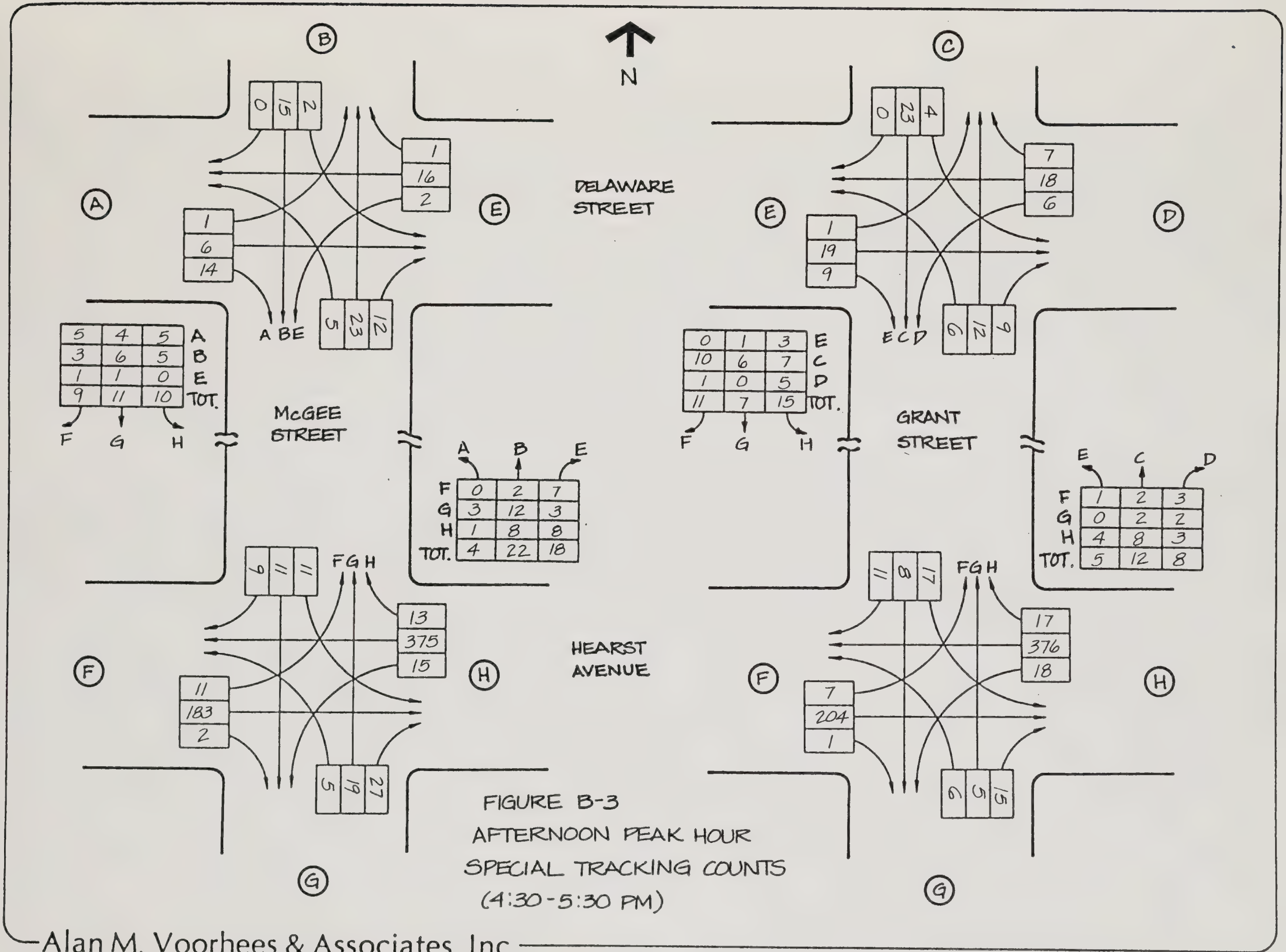

FIGURE B-3
AFTERNOON PEAK HOUR
SPECIAL TRACKING COUNTS
(4:30-5:30 PM)

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Appendix C

TRANSPORTATION TERMINOLOGY

PROJECT STAFF

Project Manager:	Georges Jacquemart, Senior Associate Registered Engineer TR1108
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Technical Assistance & Production:	Janice Eklund, Lisa Morbidelli Tonia Todd
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TRANSPORTATION TERMINOLOGY

ADT	(Average Daily Traffic) Total volume of traffic crossing a fixed point over a 24-hour period, averaged over a month, a year or several years.
Accessibility	The relative ease with which a location can be reached via various modes of transportation.
Arterial Road	A major roadway with partial control of access.
Capacity	Maximum number of vehicles, riders (transit) that can be carried during a determined period of time.
Collector Road	A roadway with uncontrolled access connecting arterials and freeways to local streets and private residences and businesses.
Directional Split	The difference in magnitude between volumes in one direction and volumes in the opposite direction on a road segment.
Freeway	High speed roadway with full control of access.
Full Control of Access	Preference is given to through traffic by providing access connections with selected public roads only and by prohibiting crossings at grade or direct private driveway connections.
HDV	Heavy Duty Vehicle. Any motor vehicle designated for transportation of property and rated at more than 6,000 lbs. from vehicle weight or designated primarily for transportation of persons and having a capacity of more than 12 persons.
Interchange	A system of interconnected roadways to provide interchange of traffic between two or more roadways, usually freeways.
Level of Service	Level of service expresses the conditions existing under various speed and volume conditions on any highway or street. These levels of service, designated A through F, from best to worst, cover the entire range of traffic operations that may occur. On many specific streets and highways, the better levels cannot be attained. Level of service E describes conditions approaching and at capacity (that is, critical density).

Level of service A describes a condition of free flow, with low volumes and high speeds, with speeds controlled by driver desires, speed limits, and physical roadway conditions.

Level of service B is in the zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed and lane of operation.

Level of service C is still in the zone of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes. Most of the drivers are restricted in their freedom to select their own speed, change lanes, or pass. A relatively satisfactory operating speed is still obtained, with service volumes perhaps suitable for urban design practice.

Level of service D approaches unstable flow, with tolerable operating speeds being maintained though considerably affected by changes in operating conditions. Fluctuations in volume and temporary restrictions to flow may cause substantial drops in operating speeds. Drivers have little freedom to maneuver, and comfort and convenience are low, but conditions can be tolerated for short periods of time.

Level of service E cannot be described by speed alone, but represents operations at even lower operating speeds than in level D, with volumes at or near the capacity of the highway. At capacity, speeds are typically, but not always, in the neighborhood of 30 mph. Flow is unstable, and there may be stoppages of momentary duration.

Level of service F describes forced flow operation at low speeds, where volumes are below capacity. These conditions usually result from queues of vehicles backing up from a restriction downstream.

Similar level of service definitions exist for typical signalized intersections:

At level of service A, there are no loaded cycles (i.e., the load factor is 0.0) and few are even close to loaded. No approach phase is fully utilized by traffic and no vehicle waits longer than one red indication.

Level of service B represents stable operation, with a load factor of not over 0.1; an occasional approach phase is fully utilized and a substantial number are approaching full use.

In level of service C stable operation continues. Loading is still intermittent, but more frequent with the load factor ranging from 0.1 to 0.3 Occasionally drivers may have to wait through more than one red signal indication.

Level of service D encompasses a zone of increasing restriction approaching instability in the limit when the load factor reaches 0.70. Delays to approaching vehicles may be substantial during short peaks within the peak period, but enough cycles with lower demand occur to permit periodic clearance of developing queues, thus preventing excessive back-ups.

Capacity occurs at level of service E. It represents the most vehicles that any particular intersection approach can accommodate. Although theoretically a load factor of 1.0 would represent capacity, in practice full utilization of every cycle is seldom attained, no matter how great the demand, unless the street is highly friction-free. A load factor range of 0.7 to 1.0 is more realistic. At capacity there may be long queues of vehicles waiting up-stream of the intersection and delays may be great (up to several signal cycles).

Level of service F represents jammed conditions.1/

Load Factor — Measure of degree of utilization of an intersection approach roadway during one hour of peak traffic flow.

1/ Source: HRB Special Report 87. Highway Capacity Manual 1965

Modal Split or Mode Split	The relative proportion of trips by each mode. For example, if 4 out of 100 trips from point A to point B were made by bus and 96 by auto, the bus and auto mode splits would be 4% and 96% respectively.
Mode of Travel	Mode of travel is the means of transportation, whether by bus, car, subway, etc.
Partial Control	In addition to access to selected public roads, only limited access to private driveways and crossings at grade are also provided.
Peak Hour(s)	The 60 minute period(s) in which volume of traffic is highest for the day. The peak hours are typically around 7 to 9 a.m. and 4 to 6 p.m.
Peak Hour/Peak Direction Factor	Percent factor expressing peak hour/peak direction traffic as proportion of ADT.
Peak Hour/Peak Direction Traffic	Highest peak hour traffic of both directions.
Uncontrolled Access	No limit to the number of accesses to the roadway is established.
Volume/Capacity Ratio, V/C Ratio	The ratio of volume of traffic to capacity for a road or road segment. The V/C ratios are useful to estimate levels of service and congestion.
Design Speed	The maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern.